

Annual Project Performance Report

1. State: California

Grant number: F-123-R-1

Grant name: Sacramento-San Joaquin Estuary Sport Fish Studies

Project number and name: #70 – Bay-Delta Sport Fish Resource Assessment – Sturgeon

2. Report Period: July 1, 2009 through June 30, 2010

3. Location of work: Congressional District #'s 1 – 16 and #18. Marin, Contra Costa, San Francisco, San Mateo, Santa Clara, Alameda, Solano, San Joaquin, Stanislaus, Sacramento, Yolo, Sutter, Colusa, Glenn, and Butte Counties.

4. Objectives:

Job #1: Population Dynamics of Sturgeon in California's Sacramento-San Joaquin Estuary — Estimate legal-sized sturgeon abundance using multiple-census and Petersen mark-recapture techniques. Determine fishing mortality, natural mortality, and survival rates from returned tags. Determine harvest, seasonality and location of harvest, and (when possible) abundance from return of data from Sturgeon Fishing Report Cards.

Job #2: Compilation of Sturgeon Commercial Passenger Fishing Boat (CPFB) Catch Records from California's Sacramento-San Joaquin Estuary — Monitor sport fishing success as an index of the sturgeon population's status.

5. If the work in this grant was part of a larger undertaking with other components and funding, present a brief overview of the larger activity and the role of this project: This work is performed under the auspices of the Interagency Ecological Program for the San Francisco Estuary (IEP) as well as DFG. The IEP provides information on the factors that affect ecological resources in the Sacramento - San Joaquin Estuary that allows for more efficient management of the estuary.

The goals of IEP are: (1) To provide for the collection and analysis of data needed to understand factors in the Sacramento-San Joaquin estuary controlling the distribution and abundance of selected fish and wildlife resources and make the data readily available to other agencies and the public; (2) To comply with permit terms requiring ecological monitoring in the estuary; (3) To identify impacts of human activities on the fish and wildlife resources; (4) To interpret information produced by the program and from other sources and, to the extent possible, recommend measures to avoid and/or offset adverse impacts of water project operation and other human activities on these resources; (5) To seek consensus for such recommendations, but to report differing

recommendations when consensus is not achieved and; (6) To provide an organizational structure and program resources to assist in planning, coordination, and integration of estuarine studies by other units of cooperating agencies, other agencies, and academia.

6. Describe how the objectives were met:

Job #1: Population Dynamics of Sturgeon in California's Sacramento-San Joaquin Estuary — Scientific staff managed databases and documentation for tagging of adult sturgeon. Laboratory staff completed database entries and mailed commemorative cards to all anglers who returned tags that had been applied to sturgeon.

Mechanical staff prepared the R/V *New Alosa* and R/V *Striper II* for use tagging adult sturgeon. Field staff caught sturgeon in San Pablo Bay and Suisun Bay with a 183 to 366-m (100 to 200 fathom), variable-mesh, drift trammel net and attached a disk-dangler reward tag to the dorsal fin of sturgeon that met specific health and size criteria. Field staff identified sturgeon to species, then measured, tagged, and released fish that were outwardly healthy and injury-free. Crews tagged sturgeon from August 10, 2009 through October 27, 2009, set nets on 69 boat-days, tended 364 net sets, and disk-tagged 457 white sturgeon and 60 green sturgeon (Attachment 1).

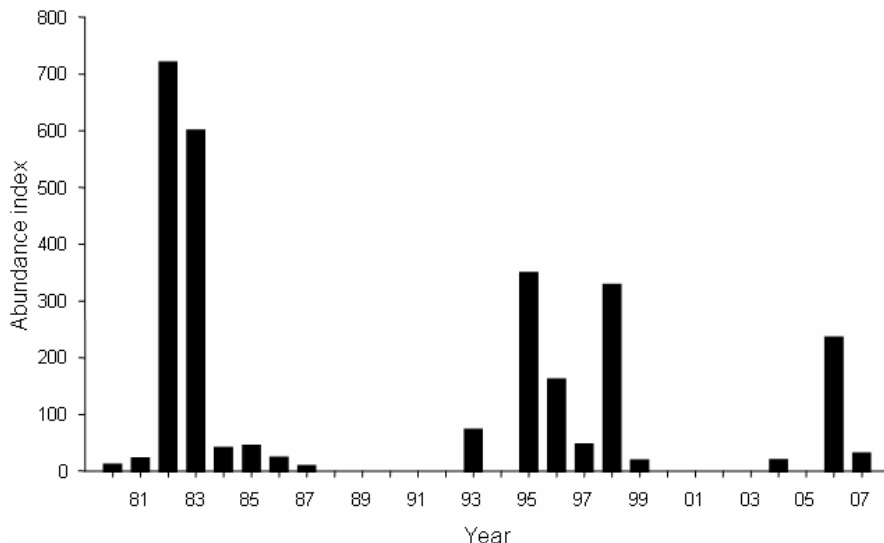
We have summarized the 2009 Sturgeon Fishing Report Card data and released a report on-topic to the public (Attachment 2). Card data has formed the quantitative basis of discussions in focus group meetings and at the California Fish and Game Commission about a range of potential fishing regulations.

We are working with a statistician to develop confidence intervals for an abundance estimate from harvest rate (from tagging data) and harvest (from Sturgeon Fishing Report Card data). The (approximate) abundance of white sturgeon 116-167 cm total length was 56,767 in 2007 and 39,817 in 2009.

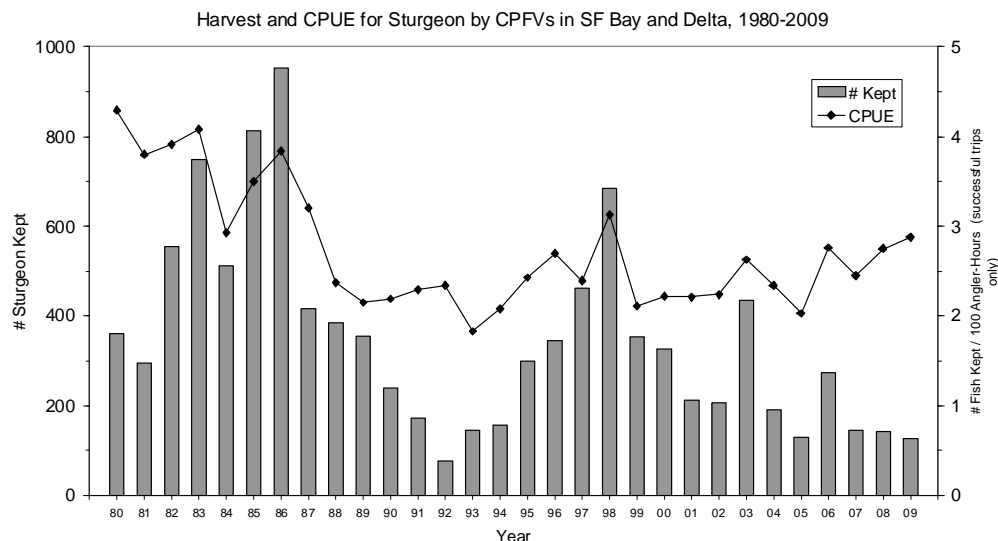
Calculation and analysis of annual sturgeon abundance, harvest rate and survival rate is on-going. Harvest rates and survival rates for legal-sized white sturgeon were 4.1% and 86.3% in 2006, while in 2007 they were 3.4% and 82.5%. Survival rates for 2008 and 2009 are not yet available, but harvest rates were 4.4% and 3.1% (respectively).

We have submitted a manuscript describing a much-needed white sturgeon year class

strength index from Bay Study otter-trawl data (see embedded figure below), completed a draft of an article on juvenile sturgeon setline data, and have nearly completed an article exploring the validity of the Bay Study index through contrasts with setline, Sturgeon Fishing Report Card, and tagging data.



Job #2: Compilation of Sturgeon Commercial Passenger Fishing Boat (CPFV) Catch Records from California's Sacramento-San Joaquin Estuary — We extracted, edited, and summarized data from daily CPFV log book records. Catch per unit effort from the CPFV fleet during the last 20 years included a peak in 1998 and a near-record low in 2005 (see embedded figure below). CPUE increased in 2006, probably in response to the recruitment of a new year-class and has since been fairly constant.



7. Discuss differences between work anticipated in grant proposal and grant agreement, and that actually carried out with Federal Aid grant funds; include differences between expected and actual costs.

Job #1: Population Dynamics of Sturgeon in California's Sacramento-San Joaquin Estuary — No differences in work performed.

Job #2: Compilation of Sturgeon Commercial Passenger Fishing Boat (CPFB) Catch Records from California's Sacramento-San Joaquin Estuary — No differences in work performed.

8. List any publications or in-house reports resulting from this work.

DuBois, J., T. Matt, and B. Beckett. 2010. 2009 Sturgeon Fishing Report Card: Preliminary Data Report. California Department of Fish and Game. Bay Delta Region, 4001 North Wilson Way, Stockton, CA 95205

DuBois, J., and Ryan Mayfield. 2009. 2009 Field Season Summary for the Adult Sturgeon Population Study. California Department of Fish and Game. Bay Delta Region, 4001 North Wilson Way, Stockton, CA 95205

Fish, M. 2010. A white sturgeon year-class index for the San Francisco Estuary and its relation to delta outflow. Interagency Ecological Program for the San Francisco Estuary Newsletter 23(2).

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2009 Field Season Summary for the Adult Sturgeon Population Study

California Department of Fish and Game
Bay Delta Region (Stockton)

By Jason DuBois and Ryan Mayfield

November 5, 2009

Field Season: August 10, 2009 – October 27, 2009
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Introduction

An adult sturgeon population study conducted by the California Department of Fish and Game (CDFG) has been ongoing intermittently since 1967. Part of the study is a “high-value” reward tagging program. Presented here is a summary of the 2009 sturgeon-tagging field season.

The tagging program is designed to understand and monitor the population dynamics of white sturgeon (*Acipenser transmontanus*) and green sturgeon (*Acipenser medirostris*), with the ultimate goal being to provide the tools to inform science-based resource management decisions. These tools include relative and absolute abundance, harvest rate, mortality rate, individual growth rates, and large-scale movement/migration patterns.

Our objective during the field season was to capture, tag, measure, and release in good condition as many sturgeon as possible and document previously-tagged sturgeon. We also collaborated with other researchers investigating various aspects of sturgeon biology.

Methods

We captured sturgeon using trammel nets deployed from the CDFG research vessels *Striper II* (fishing in Suisun Bay) and *New Alosa* (fishing in San Pablo Bay). Our field season began August 10, 2009 and ended October 27, 2009. We continued the two major alterations to our sampling methodology designed to decrease interactions with marine mammals and improve the condition of captured fish: (1) reduced the length of net in the water from 200 fathoms (~366 m) to 100 fathoms (~183 m) and (2) decreased soak time from about 45 minutes to about 35 minutes.

The *New Alosa* is a 42-foot West Coast-style combination-type fishing vessel with a 610 hp Volvo engine capable of cruising at 17 knots, and the *Striper II* is a 32-foot Southeast Alaska-style gillnetting vessel with a 6-V 53 Detroit Diesel engine capable of 7.5 knots. For the 2009 season, the *New Alosa* was berthed at the *Vallejo Municipal Marina* and the *Striper II* was berthed at the *Martinez Marina*. Each vessel typically had a standard crew of 4-5 people including a boat operator, a deckhand, two scientific aides, and a Biologist.

Both vessels were equipped with one 100-fathom (~183 m) trammel net, one hydraulic net reel, one resuscitation tub, and one tagging station. Typically, the boat operator ran the boat, operated the net hydraulics, and extracted fish from the net upon retrieval. The deckhand tended the net during deployment and assisted the boat operator by removing fish and debris from the net upon retrieval. The scientific aides measured and tagged sturgeon, recorded bycatch, collected biological data/samples, and assisted with other boat duties as needed.

The 100-fathom net was comprised of four contiguous 25-fathom (45.7 m) long by 2-fathom (3.7 m) deep sections. Each 25-fathom section was made up of a gillnet panel between two panels of trammel net. The gillnet was an Alaska salmon-style webbing

made up of multi-strand monofilament twist. The trammel net was made up of three multi-strand twisted nylon braids. The diagonal dimension of the gillnet mesh varied by 25-fathom net section and was assembled in the following order: 8", 7", 6", and 8".

Nets were set in locations selected by the boat operator to avoid known snags and (when possible) to target signs of sturgeon aggregations (e.g., many jumping sturgeon). The net was deployed across the stronger of the prevailing current or wind and took approximately five minutes to set. The deployed net was continuously monitored to detect snags, tangles, and marine mammal interactions, as well as to avoid conflicts with other vessels, channel markers, and other hazards. The nets were set as many times as possible (usually 4 – 6) in a given workday.

Data collected during each net set included, (1) the time of the start and end of the net set/retrieve, (2) the latitude/longitude of the start and end of the net set/retrieve, (3) the water temperature, (4) the number of pinnipeds patrolling and raiding the net, (5) any vessel interactions, and (6) the weather conditions (based on the Beaufort scale).

Each sturgeon brought on the vessel was either immediately removed from the net and carefully placed in the tagging cradle or placed in a plastic tub filled with water pumped from the bay. Sturgeon were placed in the tub only when processing could not be completed in a timely manner (e.g., when several came on-board from the same small section of net).

We checked each fish for old tags (i.e., PIT, disc, etc.) and evidence of a shed or clipped tag, recorded total length to the nearest cm (cm TL), attached a disc-dangler (Petersen) tag¹ to fish 100 – 201 cm TL, took a biological sample, and assessed overall condition/stress level (good, fair, or poor). The tag was placed in the flesh just below the base of the dorsal fin, midway between the anterior and posterior ends of the fin (see photo below, photo courtesy Harry Morse 2008). Each tag was labeled with a reward value of \$20, \$50, or \$100.

A few fish were too large (approx. > 180 cm) for the cradle, so were processed on the deck. Each fish in good condition was immediately released. Fish showing an unusually high level of stress and/or trauma (e.g. lack of "gilling", lack of vigor, or severe bleeding) were placed in the plastic holding tub for resuscitation and released w/o a tag as soon as their condition appeared to improve.

Recaptured fish were retagged if the old tag was too tight or loose or had caused sores to form. Captured sturgeon that had obviously been



¹ See Appendix 1.

tagged at one time but for which the tag was no longer present (i.e. wire was present below the dorsal fin) were recorded as having a “shed tag” then re-tagged and released. Sturgeon that did not have a tag or wires present but exhibited open sores or scars at the location of tagging were recorded as having “possibly shed tags”.

Biological samples were collected on certain fish for collaborators. Fin samples (< 1 cm²) were taken from the dorsal or pectoral fin on most sturgeon irrespective of size. All samples were stored in ethanol for later analysis. Acoustic transmitters were surgically implanted in eight white sturgeon (between 130 and 154 cm TL) this season as part of a collaborative effort with UC Davis researchers to track sturgeon migration. Transmitters were implanted in sturgeon collected in Suisun Bay from October 12 to October 26.

Bycatch was identified to species, counted, measured if Chinook salmon or California halibut, and released as quickly as possible. All marine mammals (Pacific harbor seals and California sea lions) within 50 meters and any instance of a marine mammal predation on fish captured in the net were recorded.

Results

We set the net 364 times during 69 boat-days² (40 calendar days) for a total of 311 hours of fishing time (~25,511 net-fathom-hours). Average fishing time per set was 52 minutes and on average the net was set 5.3 times per day.

Five hundred forty-four white sturgeon (WST) and 103 green sturgeon (GST) were captured (includes recaptured fish). Of the white sturgeon captured, 457 were then tagged. Of the green sturgeon captured, 60 were then tagged. Five white sturgeon were recaptured, one of which appeared to have shed a tag (Table 1).

Table 1. White sturgeon recaptured during 2009 sturgeon-tagging field work

Date of Recapture	Tag Number	Recapture Location	Year Tagged	Years at Large	Length at Tagging (cm TL)	Length at Recapture (cm TL)	Growth per Year (cm)
08/25/09	ST12404	Suisun Bay	2008	1	127	133	6.0
08/27/09	ST12261 ^a	Suisun Bay	2007	2	112	121	4.5
08/31/09	shed tag ^b	San Pablo Bay	N/A	N/A	N/A	165	N/A
10/05/09	HH1170	Suisun Bay	2006	3	127	133	2.0
10/08/09	HH807	Suisun Bay	2002	7	149	157	1.1

^a Also PIT tagged (#20003); ^b No tag present - unable to determine year tagged and length at tagging

We made no “true” in-season recaptures, defined for statistical purposes (i.e. assuming random mixing in the population) as a sturgeon recaptured greater than 30 days from the initial tagging date but within the 2009 tagging season. We recaptured three white sturgeon and one green sturgeon that had been at large less than 30 days.

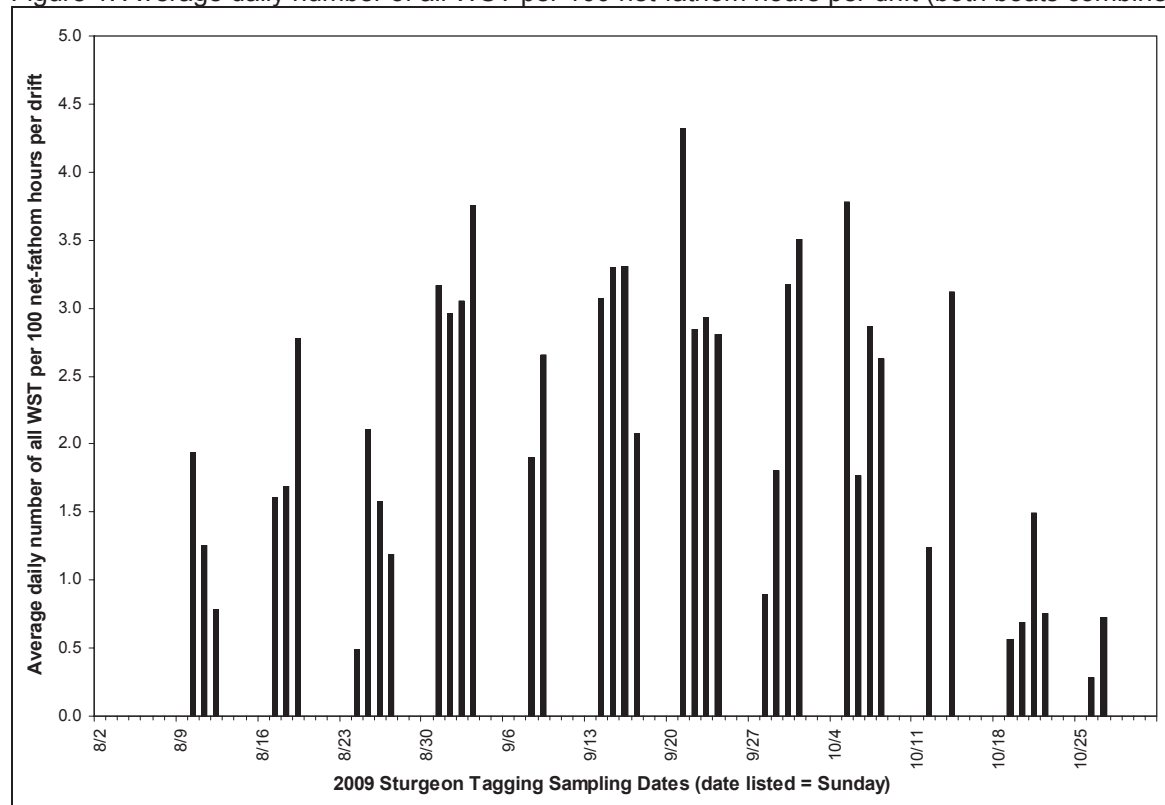
Catch per unit effort (CPUE) was calculated to estimate daily and monthly relative abundance and to compare annual estimates of relative abundance for white sturgeon. Catch was calculated as the sum of all newly-tagged fish, recaptured fish, and un-

² The *New Alosa* did not sample the weeks of September 20 and October 25.

tagged fish. The unit of effort was 100 net-fathom-hours, which is equivalent to a net 100 fathoms long fishing for one hour. Effort was calculated by weighting the soak time (i.e., the amount of time between the end of the net set and the beginning of the net retrieve) by 100% and the amount of time for the net deployment and the net retrieval by 50%.

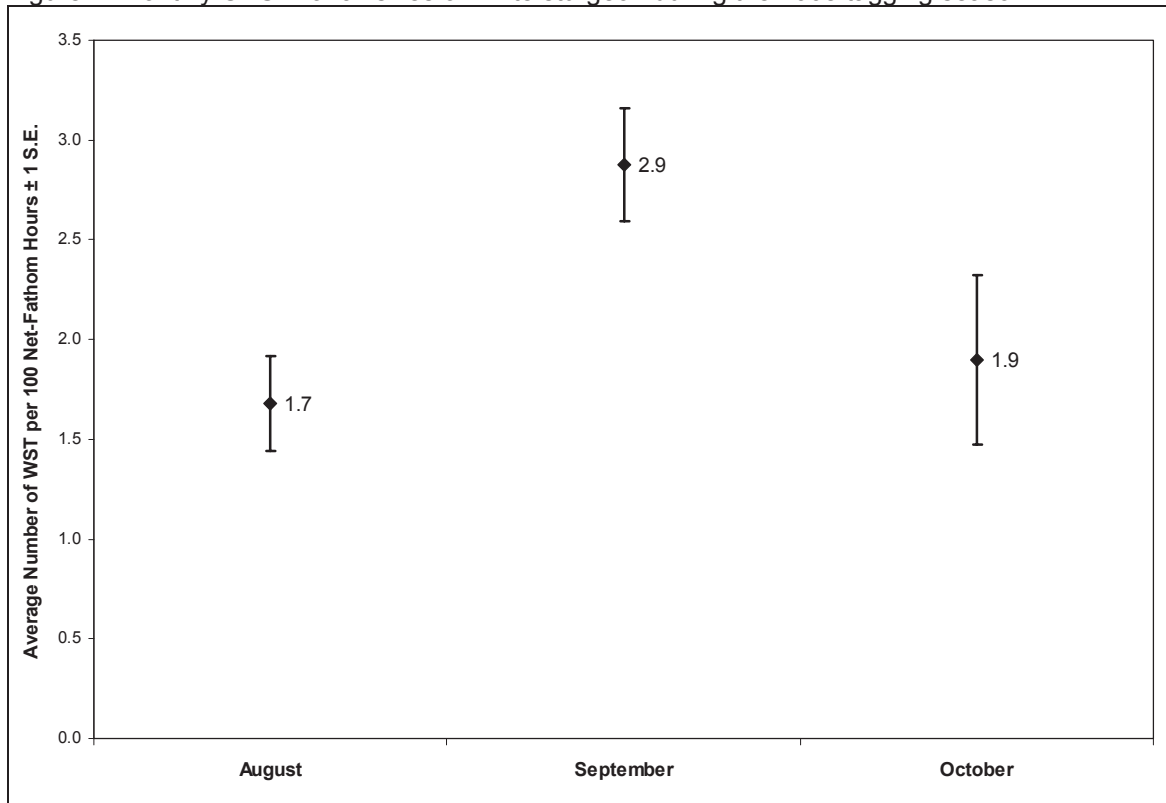
Average daily CPUE for legal-sized (117 – 168 cm TL) white sturgeon was 1.2 and for all sizes of white sturgeon was 2.2. Average daily CPUE per drift (net set) for all sizes of white sturgeon was greatest on September 21 (CPUE = 4.3; Figure 1). Exceptional average daily CPUE appeared to have occurred randomly throughout the three months of sampling and did not appear to correlate well with CPUE on adjacent days. The CPUE time series (Figure 1) did not appear to show any strong temporal autocorrelation, though some periodicity might have been present due to tidal influences.

Figure 1. Average daily number of all WST per 100 net-fathom hours per drift (both boats combined)



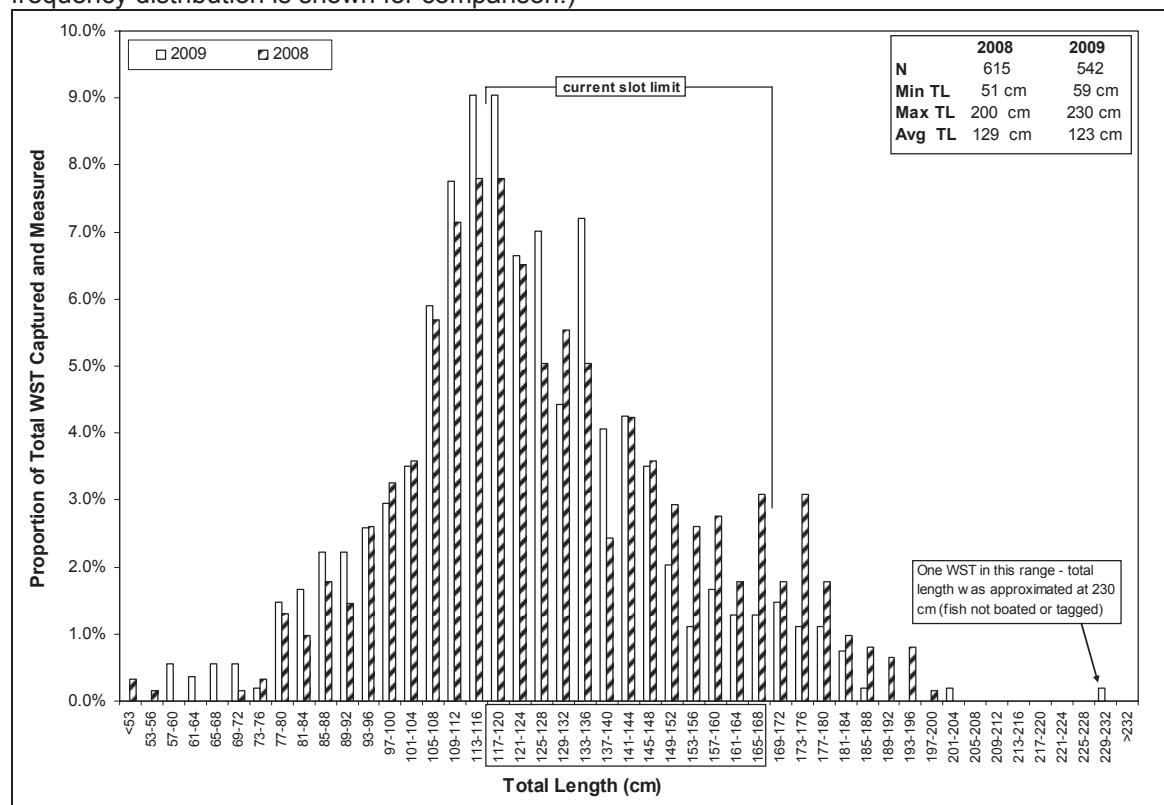
Average daily CPUE for all sizes of white sturgeon was slightly higher in September than August and October (Figure 2). August and October had similar average daily CPUE values, although October had more variability.

Figure 2. Monthly CPUE for all sizes of white sturgeon during the 2008 tagging season



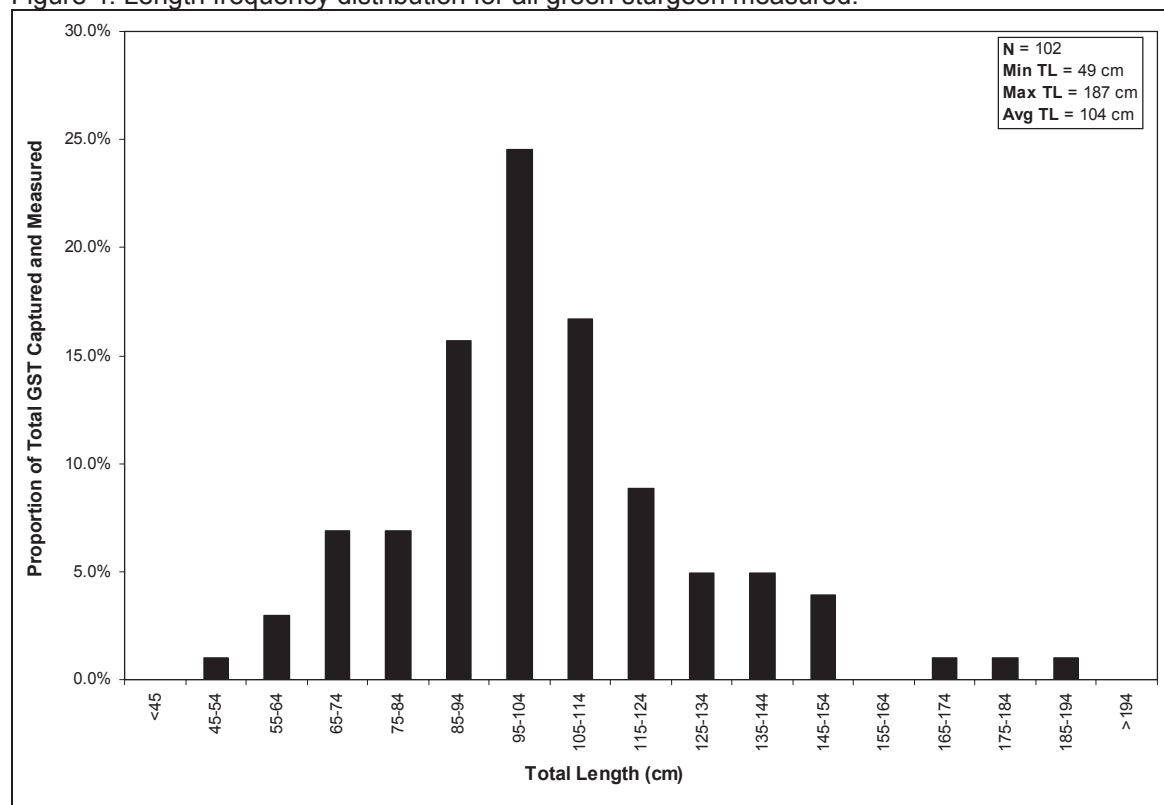
White sturgeon length frequency distribution was slightly bi-modal, with the major peaks at 113 – 116 cm TL and 117 – 120 cm TL (Figure 3). About 17% of the fish this season were between 109 and 116 cm TL, indicating that a large cohort is nearing entry into the recreational fishery. Compared to last season, we caught fewer bigger-sized white sturgeon (≥ 149 cm TL).

Figure 3. Length frequency distribution for all white sturgeon measured. The 2008 tagging season length frequency distribution is shown for comparison.)



We caught and measured 102 green sturgeon this season (Figure 4). About 25% were between 95 and 104 cm TL. The majority of green sturgeon were between 85 and 114 cm TL.

Figure 4. Length frequency distribution for all green sturgeon measured.



No bycatch was retained and most was released alive. Bycatch was more abundant and more diverse in San Pablo Bay (Table 2). Only Chinook salmon were captured more often in Suisun Bay. Bycatch was higher this season than the 2007 season (N=578 in 2007), the last time fishing operations were conducted in both bays.

California halibut (N=56) ranged from 46 – 76 cm fork length (cm FL) and averaged approximately 62 cm FL. Chinook salmon (N=44) ranged from 50 – 98 cm FL and averaged approximately 77 cm FL. Note: Most fork lengths were approximated in order to return these fish to the water quickly and safely.

In San Pablo Bay, we observed 43 instances of at least one seal within 50 meters of the net and two instances of at least one sea lion within 50 meters of the net. We recorded 12 instances of at least one seal raiding the net and one instance of at least one sea lion raiding the net.

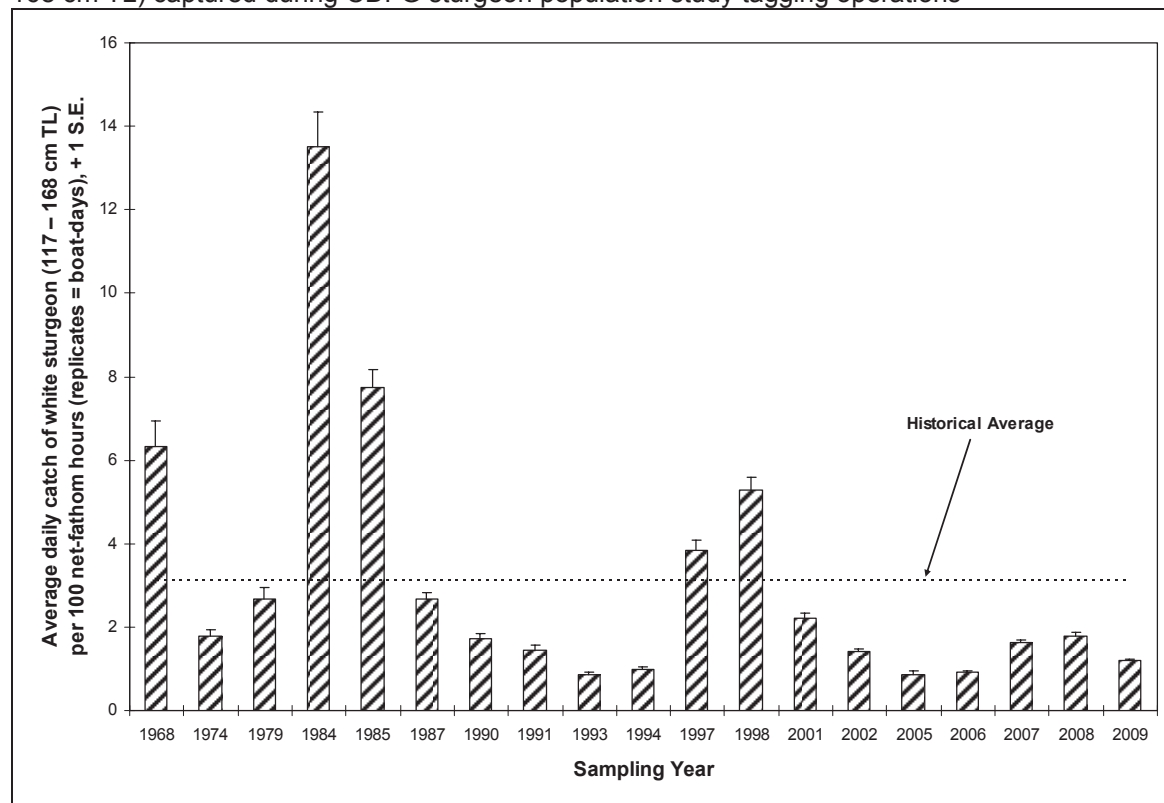
In Suisun Bay, we observed 14 instances of at least one seal within 50 meters of the nets and nine instances of at least one sea lion within 50 meters of the net. We recorded one instance of at least one seal raiding the net and one instance of at least one sea lion raiding the net.

Table 2. Numbers of other species caught (bycatch) during the 2009 sturgeon tagging season

Bycatch Species	Scientific Name	San Pablo Bay	Suisun Bay	Total	Percent of Total
Bat Ray	<i>Myliobatis californica</i>	617		617	59.7%
Brown Smoothhound	<i>Mustelus henlei</i>	28		28	2.7%
California Halibut	<i>Paralichthys californicus</i>	56		56	5.4%
Carp	<i>Cyprinus carpio</i>		1	1	0.1%
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>	1	43	44	4.3%
Diamond Turbot	<i>Hypsopsetta guttulata</i>	3		3	0.3%
Leopard Shark	<i>Triakis semifasciata</i>	93		93	9.0%
Monkey Face Eel	<i>Cebidichthys violaceus</i>	1		1	0.1%
Pipefish	<i>Syngnathus leptorhynchus</i>	3	2	5	0.5%
7-Gill Shark	<i>Notorhynchus cepedianus</i>	88		88	8.5%
Skate, un-identified	-	1		1	0.1%
Spiny Dogfish	<i>Squalus acanthias</i>	2		2	0.2%
Starry Flounder	<i>Platichthys stellatus</i>	51	26	77	7.4%
Striped Bass	<i>Morone saxatilis</i>	6	10	16	1.5%
White Croaker	<i>Genyonemus lineatus</i>	2		2	0.2%
Total		952	82	1,034	

Catch per 100 net-fathom hours of white sturgeon within the current slot limit (117 – 168 cm TL) was 1.2 and was below the historical average of 3.1 (Figure 5). Also, catch per 100 net-fathom hours was (1) lower this season than the previous two seasons and (2) lower than the historical median value (value=1.77, year=2008).

Figure 5. Average daily catch per 100 net-fathom hours of white sturgeon within current slot limit (117 – 168 cm TL) captured during CDFG sturgeon population study tagging operations



Acknowledgments

We thank the *Martinez Marina* and the *Vallejo Municipal Marina* for providing berths for our research vessels.

We thank Fish and Game Vessel Mates Ken Flowers, Mike Silva, Gary Webb, and Brian Delano; Fish and Wildlife Technician Dave Hull; Associate Biologist Michael D. Harris; Biologist Max Fish; Senior Lab Assistant Dorothy Crystal; and Scientific Aides Bill Beckett, Tim Matt, Katie Smith, Dan Fidler, Kate Erly, Michelle Gibson, Dustin Dinh, Melissa Riley, and Nick Bers. We greatly appreciate their dedication and hard work.

Appendix 1 (Tag numbers released in 2009)

\$20 Tags ST12277 – ST12299
 ST12478 – ST12499
 ST12593 – ST12599
 ST12700 – ST12813
 ST12821 – ST12829

\$50 Tags FF1277 – FF1283
 FF1285 – FF1299
 FF1477 – FF1494
 FF1496 – FF1499
 FF1593 – FF1599
 FF1700 – FF1812
 FF1821 – FF1828

\$100 Tags HH1276 – HH1299
 HH1477 – HH1499
 HH1593 – HH1599
 HH1700 – HH1812
 HH1821 – HH1828

2009 Sturgeon Fishing Report Card: Preliminary Data Report

Jason DuBois, Tim Matt, and Bill Beckett

California Department of Fish and Game
Bay Delta Region (East)
4001 North Wilson Way
Stockton, CA 95205

March 29, 2010

Summary

The 2009 Card was printed using Bay-Delta Sport Fishing Enhancement Stamp funds and then issued to any angler at no charge. Card data were managed using Sport Fish Restoration Act and Interagency Ecological Program funds.

One hundred forty thousand (140,000) Cards were printed at a cost of \$21,699 including tax and surcharge. Approximately 57,000 Cards were issued, of which 5,478 were returned to the Department and 1,914 of those Cards had data on sturgeon catch.

Anglers released 215 green sturgeon, retained 1,636 white sturgeon, and released 5,264 white sturgeon. Catch was between 10 and 16% of the total sturgeon catch ($N = 7,165$) for each of the following months: January; February; March; April; November; and December. Catch for all other months each was $\leq 7\%$ of the total catch.

Anglers reported total length measurements for 29 green sturgeon (range 12 to 72 inches, average 29 inches). Of the white sturgeon retained, anglers reported total length measurements for 1,617 (range 46 to 84 inches, average 55 inches). Three were over the legal limit of 66 inches, and none were below the legal limit of 46 inches. Of the white sturgeon released, anglers reported total length measurement for 1,067 (range 8 to 108 inches, average 38 inches).

Catch of green sturgeon was greatest in the Sacramento River from Rio Vista to Chipps Island and in Suisun Bay. Catch of white sturgeon was greatest in the Sacramento River from Rio Vista to Chipps Island and in Suisun Bay.

We recommend continuing use of Sturgeon Fishing Report Cards and a change to the 2011 Card. Aspects of sturgeon ecology and population dynamics can be better monitored by requiring anglers record the length of released fish.

Introduction

This report summarizes data from the 2009 California Sturgeon Fishing Report Card (Card). The Card became part of a suite of sport fishing regulations in March 2007 that was intended to protect California's year-round white sturgeon fishery while increasing protections for the federally-threatened green sturgeon population and adding resiliency to the conservation-dependent white sturgeon population.

The 2009 Card was distributed to any angler at no charge and was required of every angler — including minors, anglers fishing only from piers, and anglers fishing on “free fishing” days — who fished for and retained or released a sturgeon in California.

Cards were printed using Bay-Delta Sport Fishing Enhancement Stamp funds. Sport Fish Restoration Act and Interagency Ecological Program funds were used to manage Card data and prepare this report.

Cards included fields for contact information, retained fish, and released fish (Appendix 1). To aid the Department's efforts to reduce illegal commercialization of sturgeon and to enforce the daily and annual bag limits on white sturgeon, the Cards also included detachable single-use serially-numbered Card-specific tags to be placed on fish retained by anglers. Information on catch of sturgeon from 2009 Cards is complementary to on-going research conducted by the Department and others and will be used in planned articles and technical reports. Future year-specific California Sturgeon Fishing Report Card data reports will include a bibliography of documents that used Card data.

Card Distribution and Return

One hundred forty thousand (140,000) Cards were printed at a cost of \$21,699 (including tax and surcharge) then distributed beginning in late 2007 to Department offices and licensed sales

agents using the License and Revenue Branch “steelhead card distribution list”. Approximately 57,000 Cards were issued to anglers.

Anglers began returning Cards almost immediately after distribution. The few Cards returned during preparation of this report are not described here. Five thousand four hundred seventy-eight (5,478) Cards were returned and 1,914 of those had data on sturgeon catch.

Angler Data

The Card included fields for general, personal, and contact information, as well as for catch data (Appendix 1). Contact information included California fishing license number, street address, phone, and e-mail.

One hundred eighteen anglers supplied no California fishing license number, or submitted illegible or non-standard license numbers. Two of these anglers were specifically described as “under age” or under the age of 16.

Catch Data

The Card contained two sections for reporting sturgeon catch (1) Sturgeon Retained and (2) Sturgeon Released. Both sections included fields to report month, day, and location. The “Sturgeon Retained” section also contained a field for reporting length and reminded anglers only white sturgeon may be retained. The “Sturgeon Released” section also contained check boxes for species identification (green or white). Length was not required or requested for this section, but some anglers provided it.

Catch data — Anglers reported releasing 215 green sturgeon, while keeping 1,636 white sturgeon and releasing 5,264 white sturgeon (Table 1). Fifty sturgeon were not identified to species.

Table 1. White and green sturgeon catch reported on 2009 Cards

		White Sturgeon	Green Sturgeon	Unidentified Sturgeon	Overall Total
Retained	Measured	1,617	0	0	1,617
	Not Measured	19	0	0	19
	Total	1,636	0	0	1,636
Released	Measured	1,067	29	0	1,096
	Not Measured	4,197	186	50	4,433
	Total	5,264	215	50	5,529
Overall Total		6,900	215	50	7,165

One thousand two hundred forty-two (1,242) anglers reported retaining white sturgeon (Table 2). These anglers retained an average of 1.3 sturgeon, and 80 anglers retained the limit of three.

One thousand two hundred fifteen (1,215) anglers reported catching and releasing white sturgeon (Table 2). Of these anglers, 131 each caught and released between 10 and 50 fish, and one angler caught and released 141 fish.

One hundred thirty-four (134) anglers reported catching and releasing green sturgeon (Table 2). These anglers caught and released an average of 1.6 sturgeon, and nine anglers each caught and released between 4 and 11 fish.

Table 2. Summary statistics for per-angler catch from 2009 Cards with catch data

	Number of Anglers	Number of Sturgeon	Maximum Number of Sturgeon per Angler	Average Number of Sturgeon per Angler
Retained White Sturgeon	1,242	1,636	3	1.3
Released White Sturgeon	1,215	5,264	141	4.3
Green Sturgeon	134	215	11	1.6
Unidentified Sturgeon	15	50	25	3.3

Of the 1,895 anglers who caught white sturgeon, 343¹ anglers retained and released white sturgeon on the same day (average = 2.0 anglers/day, maximum = 14 anglers/day). Of these 343 anglers, one released eight in the same day. Because the length of sturgeon released was not a required field on the Card, the number of white sturgeon voluntarily conserved could not be calculated.

Length data — Green sturgeon total length ranged from 12.0 to 72.0 inches and averaged 28.5 inches (Figure 1). Retained white sturgeon total length ranged from 5.0² to 84.0 inches and averaged 54.5 inches (Figure 2). Released white sturgeon total length ranged from 8.0 to 108.0 inches and averaged 38.1 inches (Figure 3).

Note: Length was not recorded for 19 retained white sturgeon.

Lengths of retained white sturgeon were skewed slightly to the lower end of the legal slot limit (46 to 66 inches total length; Figure 2). Of the released white sturgeon for which a length measurement was reported, 225 were within the slot limit (Figure 3). The majority was below the slot limit (N = 745). Only 97 were above the slot limit.

Note: The three lengths over the limit were legible and confirmed as accurate entries in the database. One angler retained another white sturgeon within the slot limit, one angler released a white sturgeon but did report a length, and one angler caught only the one oversized fish reported. Each angler used the appropriate number of tags for the number of fish retained. The undersized length of 5 inches was legible and confirmed as an accurate entry; this length was more than likely an entry error made by the angler.

¹ Fourteen individual anglers retained and released white sturgeon on three separate days, 39 individual anglers retained and released white sturgeon on two separate days, and 223 individual anglers retained and released white sturgeon on one day.

² More than likely an angler entry error, value not included in average

Figure 1. Total lengths of green sturgeon as reported on 2009 Cards

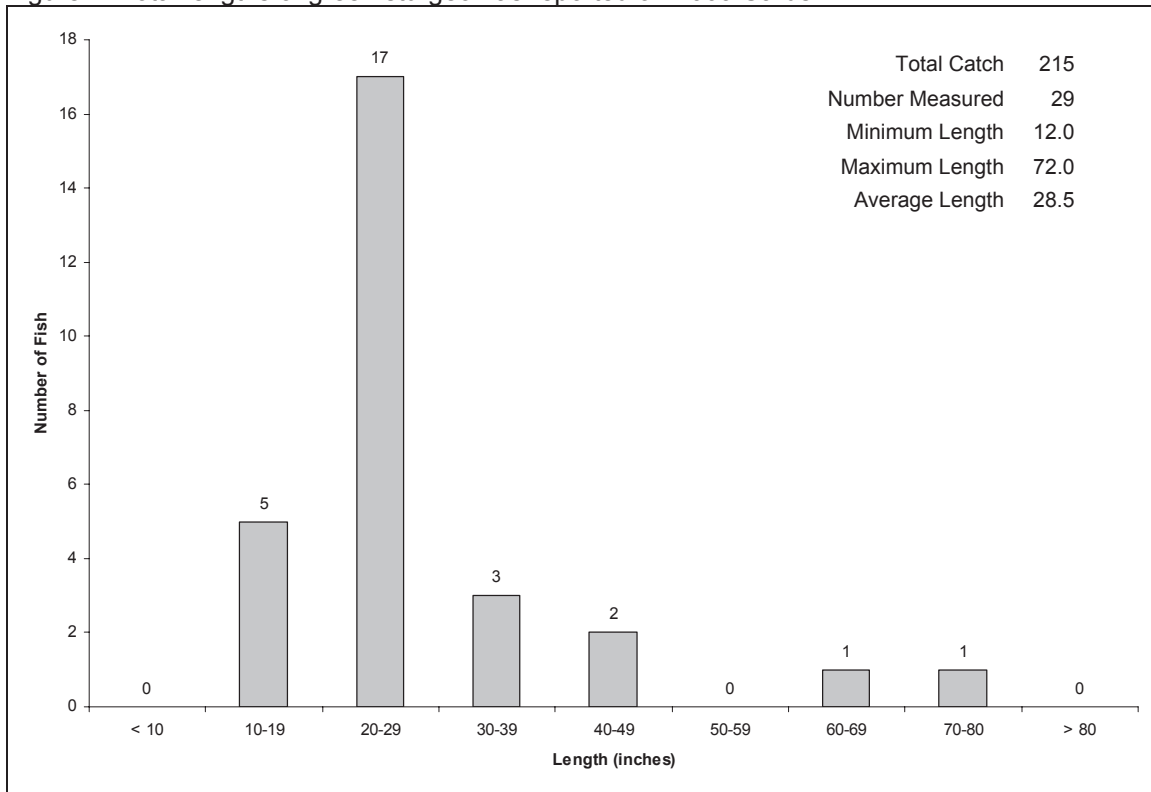


Figure 2. Total lengths of white sturgeon retained as reported on 2009 Cards

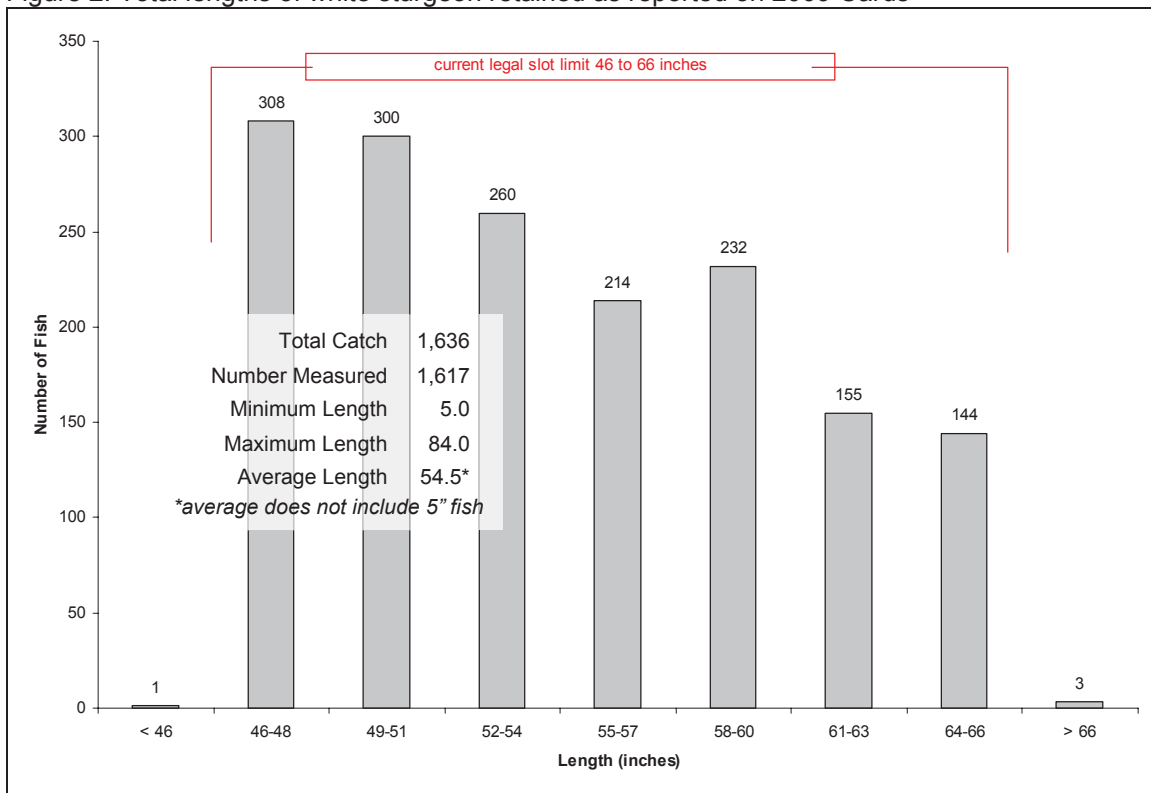
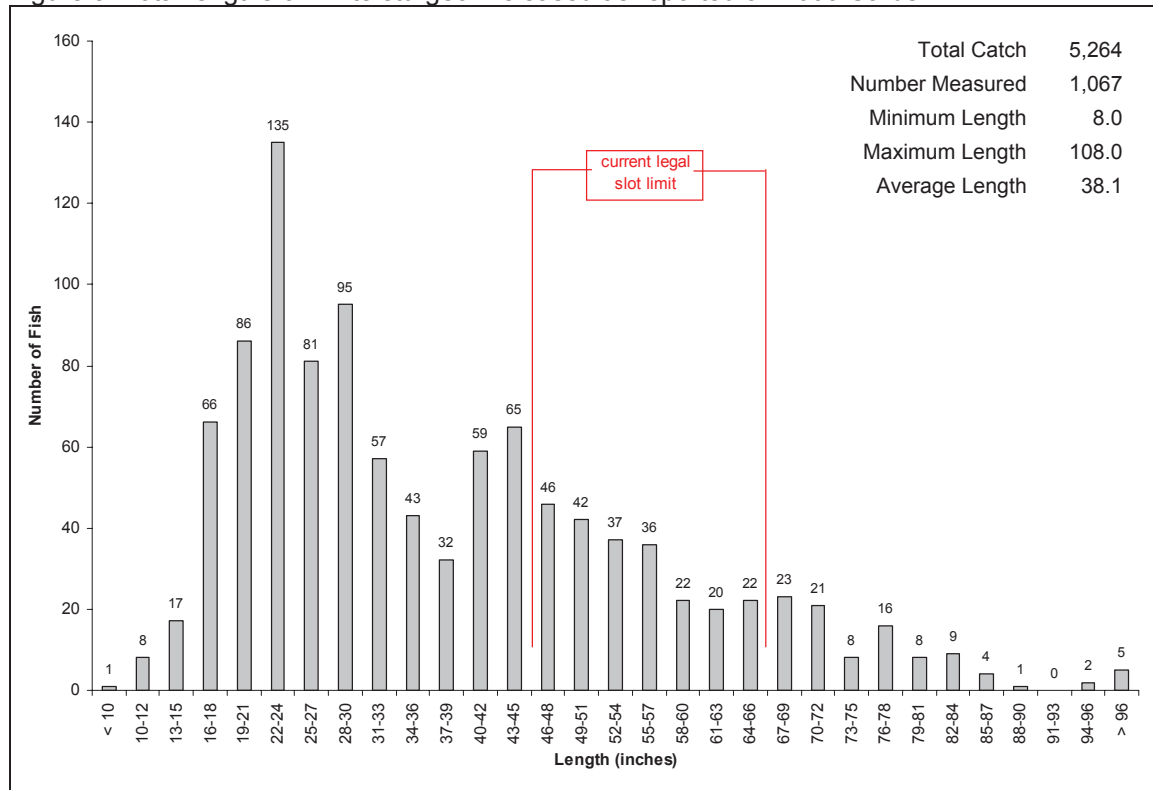


Figure 3. Total lengths of white sturgeon released as reported on 2009 Cards



Seasonality — Catch of green sturgeon and white sturgeon was greatest during the winter and spring (Table 3). Catch per month was between approximately 10 and 16% of the total sturgeon catch (N = 7,165) for each of the following months: January; February; March; April; November; and December (Table 3). Catch for all other months each was $\leq 7\%$ of the total catch.

Table 3. Green sturgeon and white sturgeon catch per month and per season (Winter=December-February, Spring=March-May, Summer=June-August, Fall=September-November)

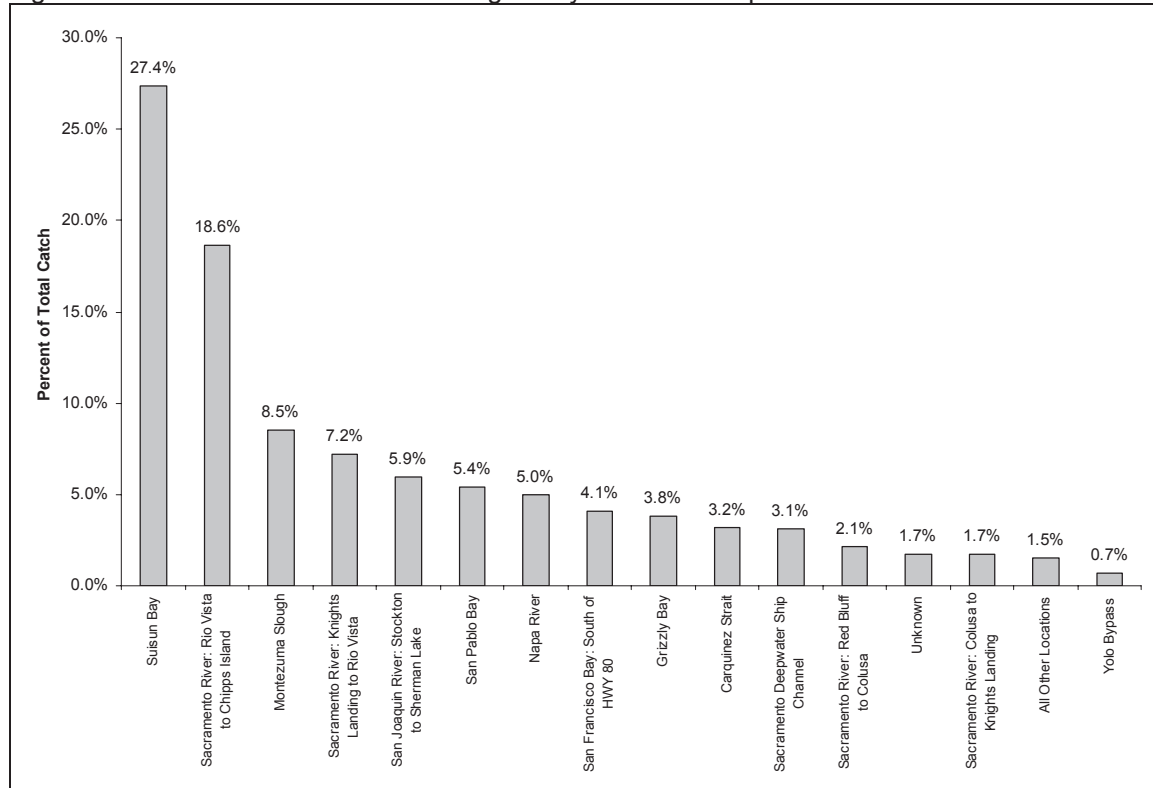
Month	White Sturgeon	Green Sturgeon	Unknown Sturgeon	Catch Total	Percent of Total
Not given	16	0	25	41	0.6%
January	913	24	6	943	13.2%
February	1,062	19	1	1,082	15.1%
March	1,131	24	6	1,161	16.2%
April	764	22	1	787	11.0%
May	415	23	3	441	6.2%
June	208	18	1	227	3.2%
July	155	10	0	165	2.3%
August	134	11	1	146	2.0%
September	194	10	0	204	2.8%
October	464	19	0	483	6.7%
November	719	17	4	740	10.3%
December	725	18	2	745	10.4%
Totals	6,900	215	50	7,165	

Season*	White Sturgeon	Green Sturgeon	Unknown Sturgeon	Catch Total	Percent of Total
Winter	2,700	61	9	2,770	38.9%
Spring	2,310	69	10	2,389	33.5%
Summer	497	39	2	538	7.6%
Fall	1,377	46	4	1,427	20.0%
Totals	6,884	215	25	7,124	

*does not include fish from month "Not given"

Location data — Sturgeon were collected from 24 of the 25 locations listed on the Card (Figure 4). Locations where between 1 and 50 sturgeon were collected were grouped as “All Other Locations” (N = 10). Location codes were either not specified or were illegible (grouped as “Unknown”; Figure 4) for 39 retained white sturgeon, 59 released white sturgeon, and 26 unidentified sturgeon.

Figure 4. Percent of total catch of all sturgeon by location as reported on 2009 Cards



Catch of green sturgeon was greatest in the Sacramento River from Rio Vista to Chipps Island and from Suisun Bay (Table 4). Catch of white sturgeon was greatest from Suisun Bay and in the Sacramento River from Knights Landing to Rio Vista (Tables 5 and 6). About 66% of anglers who reported catching white sturgeon (N = 1,895), caught between 1 and 2 fish each (Figure 5).

Figure 5. Frequency distribution of white sturgeon catch per angler as reported on 2009 Cards (number of anglers above each column)

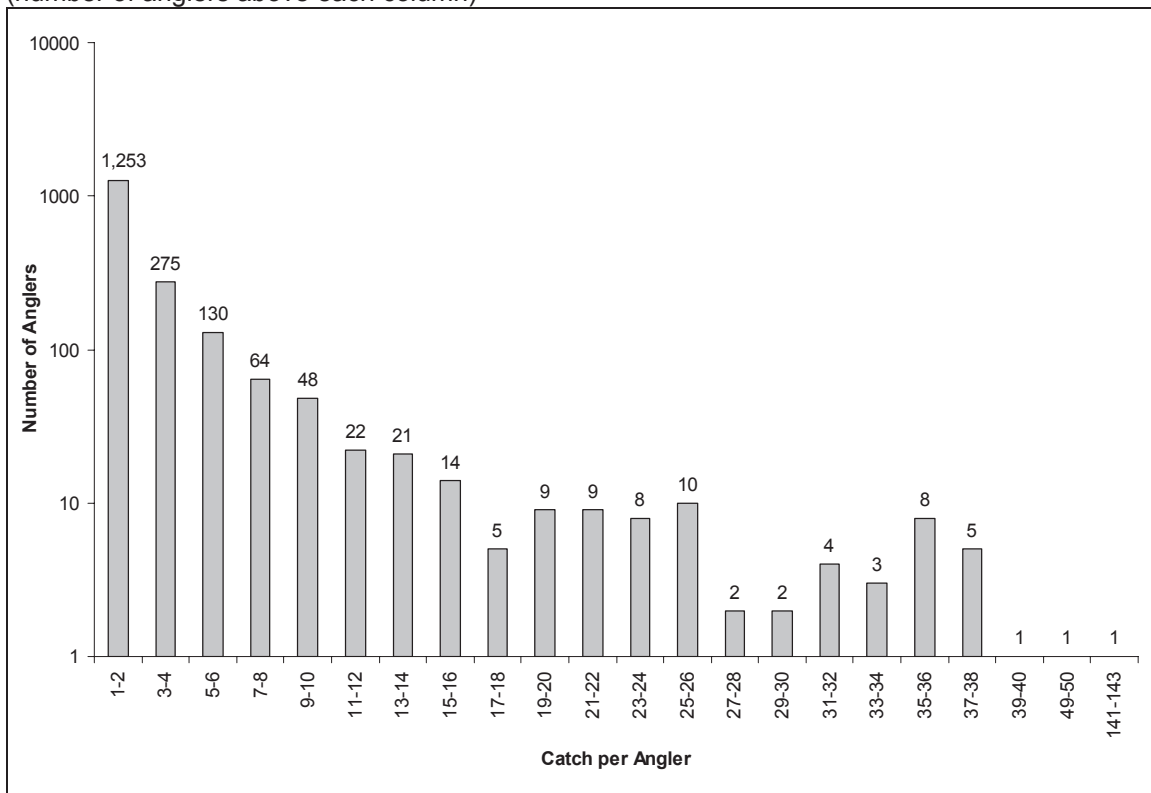


Table 4. Green sturgeon catch and associated length data by location and season as provided on 2009 Cards. The five locations where total catch was highest were ranked. Seasons were defined as follows: Winter=December-February, Spring= March-May, Summer=June-August, Fall=September-November

Location Code	Location Name	Rank of Catch	Number of Anglers	No Date of Capture	Winter Catch	Spring Catch	Summer Catch	Fall Catch	Total Catch	Number Measured	Minimum Length (inches)	Maximum Length (inches)	Average Length (inches)
	Unknown		-	-	-	-	-	-	0				
1	Sacramento River: Red Bluff to Colusa		7	-	1	3	4	1	9				
2	Sacramento River: Colusa to Knights Landing		-	-	-	-	-	-	0				
3	Sacramento River: Knights Landing to Rio Vista		8	-	3	3	2	1	9				
4	Sacramento River: Rio Vista to Chipps Island	1	35	-	26	9	16	20	71	10	18.0	72.0	38.0
5	Feather River		-	-	-	-	-	-	0				
6	American River		-	-	-	-	-	-	0				
7	Sacramento Deepwater Ship Channel		1	-	1	-	-	-	1				
8	Yolo Bypass		1	-	1	-	-	-	1				
9	Montezuma Slough	3	14	-	8	6	3	-	17	1	19.0	19.0	19.0
10	Napa River	4	11	-	1	8	5	2	16	3	24.0	26.0	25.0
11	Petaluma River		-	-	-	-	-	-	0				
12	San Joaquin River: Upstream of HWY 140 bridge		-	-	-	-	-	-	0				
13	San Joaquin River: HWY 140 bridge to Stockton		1	-	-	3	-	-	3	3	24.0	31.0	27.3
14	San Joaquin River: Stockton to Sherman Lake	4	11	-	5	6	1	4	16	2	22.0	26.0	24.0
15	Old River		-	-	-	-	-	-	0				
16	San Pablo Bay	5	12	-	1	9	2	2	14				
17	Carquinez Strait		7	-	1	6	1	1	9	1	21.0	21.0	21.0
18	Suisun Bay	2	25	-	10	14	4	11	39	7	12.0	30.0	20.7
19	Grizzly Bay		6	-	2	2	-	3	7	1	22.0	22.0	22.0
20	San Francisco Bay: North of HWY 80		1	-	-	-	-	1	1				
21	San Francisco Bay: South of HWY 80		2	-	1	-	1	-	2	1	35.0	35.0	35.0
22	Pacific Ocean: North of Golden Gate Bridge		-	-	-	-	-	-	0				
23	Pacific Ocean: Golden Gate Bridge to Point Sur		-	-	-	-	-	-	0				
24	Pacific Ocean: Point Sur to San Diego		-	-	-	-	-	-	0				
25	Any reservoir or lake		-	-	-	-	-	-	0				
Totals			142*	0	61	69	39	46	215	29			

* = 8 anglers fished and caught a green sturgeon at 2 different locations, 126 anglers fished and caught a green sturgeon at 1 location

Table 5. Retained white sturgeon catch and associated length data by location and season as provided on 2009 Cards. The five locations where total catch was highest were ranked. Seasons were defined as follows: Winter=December-February, Spring= March-May, Summer=June-August, Fall=September-November

Location Code	Location Name	Rank of Catch	Number of Anglers	No Date of Capture	Winter Catch	Spring Catch	Summer Catch	Fall Catch	Total Catch	Number Measured	Minimum Length (inches)	Maximum Length (inches)	Average Length (inches)
	Unknown		32	-	12	17	3	7	39	38	46.0	66.0	53.9
1	Sacramento River: Red Bluff to Colusa		49	-	3	51	1	-	55	53	46.0	84.0	56.9
2	Sacramento River: Colusa to Knights Landing		61	-	24	45	-	1	70	70	46.0	66.0	56.7
3	Sacramento River: Knights Landing to Rio Vista	2	174	-	67	139	-	11	217	217	46.0	66.0	55.7
4	Sacramento River: Rio Vista to Chipps Island	3	162	-	80	53	9	58	200	197	46.0	67.0	54.7
5	Feather River		4	-	1	3	-	-	4	4	59.0	66.0	61.3
6	American River		-	-	-	-	-	-	0	-	-	-	-
7	Sacramento Deepwater Ship Channel		38	-	27	9	2	16	54	54	46.0	66.0	54.6
8	Yolo Bypass		14	-	9	7	-	2	18	18	48.0	65.0	54.2
9	Montezuma Slough		84	-	39	44	9	16	108	107	46.0	65.0	54.2
10	Napa River		80	-	34	42	11	2	89	83	46.0	66.0	53.5
11	Petaluma River		6	-	1	5	-	-	6	5	49.0	65.0	58.0
12	San Joaquin River: Upstream of HWY 140 bridge		1	-	-	1	-	-	1	1	64.0	64.0	64.0
13	San Joaquin River: HWY 140 bridge to Stockton		13	-	4	10	-	2	16	16	47.0	62.0	54.3
14	San Joaquin River: Stockton to Sherman Lake		51	-	25	19	2	18	64	64	46.0	66.0	52.8
15	Old River		2	-	1	-	1	-	2	2	46.0	47.0	46.5
16	San Pablo Bay	5	95	-	32	66	7	7	112	109	46.0	65.0	53.0
17	Carquinez Strait		45	-	13	17	16	9	55	54	46.0	66.0	54.4
18	Suisun Bay	1	266	-	101	110	35	79	325	324	46.0	66.0	53.7
19	Grizzly Bay		47	-	26	14	6	13	59	59	46.0	65.0	52.8
20	San Francisco Bay: North of HWY 80		11	-	7	3	1	3	14	14	49.0	65.0	57.2
21	San Francisco Bay: South of HWY 80	4	107	-	108	6	2	11	127	127	5.0	65.0	55.1**
22	Pacific Ocean: North of Golden Gate Bridge		1	-	1	-	-	-	1	1	63.0	63.0	63.0
23	Pacific Ocean: Golden Gate Bridge to Point Sur		-	-	-	-	-	-	0	-	-	-	-
24	Pacific Ocean: Point Sur to San Diego		-	-	-	-	-	-	0	-	-	-	-
25	Any reservoir or lake		-	-	-	-	-	-	0	-	-	-	-
Totals			1,343*	0	615	661	105	255	1,636	1,617			

* = 3 anglers caught and retained fish at 3 different locations, 95 anglers caught and retained fish at 2 different locations, and 1,144 anglers caught and retained fish at 1 location

** Average not including minimum length (5") is 55.5; minimum length for location excluding 5" fish is 46.0

Table 6. Released white sturgeon catch and associated length data by location and season as provided on 2009 Cards. The five locations where total catch was highest were ranked. Seasons were defined as follows: Winter=December-February, Spring= March-May, Summer=June-August, Fall=September-November

Location Code	Location Name	Rank of Catch	Number of Anglers	No Date of Capture	Winter Catch	Spring Catch	Summer Catch	Fall Catch	Total Catch	Number Measured	Minimum Length (inches)	Maximum Length (inches)	Average Length (inches)
	Unknown		26	12	16	10	5	16	59	13	16.0	96.0	60.1
1	Sacramento River: Red Bluff to Colusa		24	-	30	56	3	-	89	3	69.0	82.0	73.7
2	Sacramento River: Colusa to Knights Landing		32	-	11	41	1	-	53	5	67.0	80.0	73.0
3	Sacramento River: Knights Landing to Rio Vista	5	124	-	103	128	10	46	287	18	16.0	80.0	48.0
4	Sacramento River: Rio Vista to Chipps Island	2	245	-	545	180	53	281	1,059	160	12.0	108.0	33.7
5	Feather River		3	-	1	2	-	-	3				
6	American River		1	-	-	-	-	1	1				
7	Sacramento Deepwater Ship Channel		43	-	83	34	15	34	166	34	12.0	96.0	40.1
8	Yolo Bypass		10	-	10	7	-	15	32	11	8.0	42.0	29.5
9	Montezuma Slough	3	152	1	204	195	51	30	481	73	14.0	103.0	37.4
10	Napa River		106	-	62	134	34	20	250	68	18.0	78.0	37.6
11	Petaluma River		7	-	2	6	5	5	18				
12	San Joaquin River: Upstream of HWY 140 bridge		6	-	1	1	2	4	8	1	24.0	24.0	24.0
13	San Joaquin River: HWY 140 bridge to Stockton		3	-	-	7	-	-	7	6	31.0	61.0	44.8
14	San Joaquin River: Stockton to Sherman Lake	4	81	-	148	96	20	85	349	51	10.0	77.0	28.3
15	Old River		2	-	1	1	-	-	2	1	20.0	20.0	20.0
16	San Pablo Bay		108	-	88	135	10	22	255	32	14.0	77.0	44.6
17	Carquinez Strait		70	-	40	51	33	41	165	23	15.0	66.0	32.8
18	Suisun Bay	1	346	3	517	501	125	450	1,596	436	10.0	98.0	34.7
19	Grizzly Bay		62	-	89	47	23	48	207	54	22.0	82.0	53.5
20	San Francisco Bay: North of HWY 80		3	-	3	1	-	6	10				
21	San Francisco Bay: South of HWY 80		47	-	130	16	2	14	162	77	24.0	84.0	52.5
22	Pacific Ocean: North of Golden Gate Bridge		3**	-	-	-	-	3	3				
23	Pacific Ocean: Golden Gate Bridge to Point Sur		1	-	-	-	-	1	1				
24	Pacific Ocean: Point Sur to San Diego		1	-	1	-	-	-	1	1	69.0	69.0	69.0
25	Any reservoir or lake		-	-	-	-	-	-	0				
		Totals	1,506*	16	2,085	1,649	392	1,122	5,264	1,067			

* = 2 anglers caught and released fish at 5 different locations, 11 anglers caught and released fish at 4 different locations, 44 anglers caught and released fish at 3 different locations,

162 anglers caught and released fish at 2 different locations, and 996 anglers caught and released fish at 1 location

**Anglers contacted - confirmed fish caught in Humboldt Bay

Discussion

The 2009 Sturgeon Fishing Report Cards provided pertinent information for relatively little cost. We recommend continuing use of Sturgeon Fishing Report Cards.

Highlights of information from 2009 Cards include the following:

- (1) Thousands of anglers took great care completing the Cards and many volunteered information and/or comments that proved both interesting and helpful.
- (2) Most anglers who took the time to submit their Card never caught a sturgeon, and an average successful angler retained less than half the annual bag limit of three white sturgeon.
- (3) Just three strong white sturgeon age-classes appeared susceptible to sport fishing gear.

From the 2009 Card data, it was clear that minor changes to subsequent-year Sturgeon Fishing Report Cards and management of the Program could provide more and better information for little or no cost. These changes include at least the following:

- (1) The number of white sturgeon caught but voluntarily released and aspects of sturgeon population dynamics can be monitored better if the length of legal- and under-sized released fish is required.
- (2) Additional outreach via the internet would likely increase the proportion of Cards that are returned and the quality of information on Cards that are returned.

Acknowledgements

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